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ABSTRACT

Total Quality Management (TQM), a technique traditionally reserved for the manufacturing sector, has recently spread to service companies, government agencies, and educational institutions. TQM places responsibility for quality problems with management rather than on the workers. A principal concept of TQM is the management of Process Variation, whereby variations in production or quality within a manufacturing or service process are viewed as "special cause" variations, which can be removed by employees operating the process; or "common cause" variations, which require management action to change some inherent feature of the process. The hallmark of TQM is the continual improvement of processes, achieved through a shift in focus from outcomes (or products) to the processes that produce them. TQM achieves its objectives through data collection and analysis. Flow charts, cause and effect diagrams, and other Total Quality Tools are used to understand and improve processes. In 1986, Delaware County Community College (DCCC) began implementing TQM. The college president requested that each administrative unit identify its area mission and develop flow charts for key area processes. In the Institutional Research Office (IRO), internal surveys were utilized to rate the importance of research processes. The IRO emphasis on small, incremental improvements in processes has reduced the amount of crisis management required to run the office. In addition, the IRO has collected data on the flow of external requests for information which significantly reduced turn-around time, and greatly facilitated the planning and scheduling of research activities. Finally, the implementation of TQM has shifted the focus of the IRO to a more consultative role. A list of the IRO key processes is included. (PAA)

Total Quality Management: Institutional Research Applications

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Abstract

Many American businesses, faced with declining marketshare, increasing public demand for better quality goods and services, and the impending shift to a global economy, have turned to Total Quality Management as a philosophy that might enable them to survive. In recent years nonprofit companies, government agencies, and educational institutions have become interested in Total Quality Management as an approach to improving quality and conserving resources. This paper describes how Total Quality Management has been applied in the Institutional Research Office of a college that began implementing Total Quality Management in 1986.

Background and History

The philosophy and methods that underlie Total Quality Management have a long history. The principles of statistical quality control, developed in the 1930's by Shewhart, were vital to the American military effort during World War II. The techniques were valuable enough to be classified as military secrets until the end of the war with Germany (Ishikawa, 1985). During the post-war period their use diminished in the United States. Quality control experts continued to use the tools, but quality was not the primary focus of executives and managers. American business had entered a period of explosive growth as it attempted to meet the pent-up demand for consumer goods. Quantity was favored over quality during this era of planned obsolescence.

In Japan, however, the post-war period was a time of learning about quality principles and tools, with the help of W. Edwards Deming, the American statistician, and Joseph Juran, the quality expert. Although the movement had its roots in statistical quality control and is often referred to by the Japanese as Total Quality Control, it is radically different from the traditional approach to quality.

In the traditional approach, quality is the designated domain of the Quality Control or Quality Assurance department. In Total Quality Management, top management must be committed to and involved in practicing the methods. Employees at all levels in the organization are taught the principles and tools and how to use them to study processes on the job. The Quality Department supports and enables these efforts, but it does not take sole

responsibility for quality throughout the organization.

American business began to notice Total Quality Management during the 1980's. Media reports describing the phenomenal improvements in quality and reductions in process variation achieved by some Japanese companies generated interest, particularly in the manufacturing sector, which had suffered devastating decline in the United States. Dr. Deming was rediscovered and has worked with companies whose top management is willing to adopt Deming's 14 points (Deming, 1986; Walton, 1986).

More recently, interest in Total Quality Management has spread to service companies (banks, utilities, hospitals), government agencies, and educational institutions. These organizations are facing increasing public demand for better quality service. Total Quality Management is appealing to publicly supported organizations because of its precept that continuous quality improvement ultimately reduces costs. Traditionally, managers have assumed that better quality and higher costs go hand-in-hand. However, the promise of increasing quality and lower costs can be fulfilled only if managers can shift from a short term, "bottom line" focus to a long term focus on how well the organization is fulfilling its mission.

Philosophy and Methods

The Transformation. Total Quality Management requires a radical transformation in how an organization is run. The philosophy provides a new lens for viewing managers' and employees' responsibilities. Rather than assuming that employees are to blame for quality problems, Total Quality Management

assumes that few quality problems are the workers' responsibility. Managers are responsible for the systems in an organization, and it is these systems that generate most of the quality problems. Management is also responsible for providing employees with the resources to perform their jobs. These resources include education and training in the Total Quality methods and tools.

Process Variation. Management must understand that variation is a normal feature of all processes. The control chart tool helps to distinguish between "special cause" variation, which usually can be explained and removed by the employees who operate the process, and "common cause" variation, an inherent feature of the process that requires management action if it is to be reduced.

Continuous Process Improvement. The hallmark of Total Quality Management is its focus on Kaizen: continually improving processes in order to provide customers with steadily improving quality. (Imai, 1986). American managers tend to focus on process outcomes (products or services), rather than on the processes themselves. Traditional quality control inspects the outputs of processes to identify defects or errors. These defects or errors must be thrown away or fixed. Either approach is very costly. (A third option, sending them to the customer, does exist. But Deming warns that this is probably the most costly option and that the true cost of a dissatisfied customer can never be known. Focusing on process forces managers to look "upstream" for sources of defects or errors. Removing these causes (prevention)

improves the process, which in turn improves the product or service and lowers the long term cost.

Customer Focus. Total Quality Management requires an obsession with customers: listening to them, gathering data to understand how they use products and services, studying their current needs, and anticipating their future needs. The term "customer" includes not only the external customers who use a product or service, but also the "internal" customers who receive the outputs of processes in the organization.

Importance of Data. Total Quality Management achieves its objective of continuous process improvement through data collection. Data are used to identify customer needs and to understand how customers use a product or service. Data are collected on processes to study how they operate and to determine if a process is stable (i.e., producing only random or common cause variation).

The Plan-Do-Check-Act (PDCA) cycle (Deming, 1986) guides data collection efforts. Typically, multiple PDCA cycles are required, with each cycle focusing more narrowly on the process being studied. The actions taken depend on the results of the data collection and analysis. For example, process improvement efforts are appropriate for stable processes. The improvement efforts must be followed by additional data collection to evaluate the impact of the improvement effort. Once a process is operating as desired, it is standardized; data collection must continue to monitor the process to prevent it from slipping back to an earlier, less improved state.

Unstable processes are not appropriate candidates for

improvement efforts. They must be stabilized before improvements are attempted. Attempts to improve an unstable process (known as "tampering" with the process) will increase the process variation (Deming, 1986).

Total Quality Tools. Once the transformation in managerial thinking has occurred, the wealth of opportunities for process improvement can seem overwhelming. At this point the tools of Total Quality come into play; all of the tools, in one way or another, serve to focus process improvement efforts. There are seven "basic" tools (Brassard, 1989; Ishikawa, 1982).

Flow charts, the cause and effect diagram, and the Pareto chart are helpful in problem identification. Flow charts (top-down, process, and matrix flow charts) identify the steps in a process. They are used to understand how a process is operating, to identify problem areas and complexity (extra steps), and to focus data collection efforts. The cause and effect diagram (also known as a fishbone or Ishikawa diagram) identifies and categorizes possible causes of a problem. It helps narrow the focus for data collection and aids in the search for root causes. The Pareto chart is a bar graph showing the results of data collected on hypothesized causes of a particular problem. The Pareto chart separates the "vital few" causes of the problem being studied from the "trivial many" causes, thereby aiding in development of improvement efforts (Squires, 1986).

Run charts, control charts, histograms, and scatter diagrams are used to study patterns of variation in processes. The uses of run charts, histograms, and scatter diagrams are familiar to

researchers and evaluators. In Total Quality Management these tools are applied to processes within an organization. The control chart is a form of run chart with statistically determined upper and lower control limits. Different types of control charts have been developed for different types of data, but they all have the same purpose: to determine if a process is stable (generating only common cause variation). The control chart is a diagnostic tool that provides guidelines for appropriate action.

In addition to these seven basic tools, there are seven management and planning tools, described in detail by Brassard (1989). All of the tools are easy to learn, simple to use, and powerful for focusing process improvement efforts. Yet applying them and making them part of daily management is very difficult for most people, because the Total Quality Management philosophy demands a new way of thinking about the work we do. The difficulty is compounded by the literature's heavy use of examples and models from manufacturing settings. Examples from service companies are beginning to surface, but examples from non-profit organizations are rare. The final section of this paper tries to make Total Quality Management ideas more accessible to researchers and evaluators by describing how a Research Office in an educational institution is seeking to transform itself.

Applications: Institutional Research Examples

Delaware County Community College began implementing Total Quality Management in 1986. The plan for implementation and progress to date are described elsewhere (DeCosmo, Parker, &

Heverly, in press). This paper focuses on examples from the Research Office of the college, because its function in the organization most closely resembles the function of evaluation offices.

Managing the Office. Although several Total Quality Management tools are commonly used by Research Office staff in conducting studies for the college, it was difficult to make the transition to daily applications and to managing the Office itself. The transformation required extensive education about Total Quality. Once the transformation had occurred, the staff began to take a different view of the Office's work. Studies and projects that occur on a regular basis are now approached with the expectation that improvements can be made. Problems, errors, or questions that occurred during previous cycles are documented and reviewed when a new cycle begins. The emphasis is on small, incremental changes and improvements to processes. One long term result is a reduction in the amount of "fire-fighting" and crisis management required to run the office.

Studying Processes, Making Them Visible. One long-standing problem in the Research Office has been that various and sundry requests for information continually stream into the Office, interrupting ongoing work on scheduled projects. No data existed on the volume or pattern of these requests; as a result, there was no way to plan other projects around the expected volume of these "ad hoc" requests.

In June, 1988, staff began collecting data on each "ad hoc" request, noting the source and type of request and tracking

progress in responding to the request. The data showed a fairly consistent pattern from year to year, with peaks in October and January/February (see Figure 1).

The data collection yielded several benefits. First, it served as an unobtrusive assessment of internal customer needs. In response to some of the requests, new persons were added to distribution lists of Research Office reports. In other instances reports were modified to provide new information customers were requesting. These changes appear to have helped the Office better understand customer needs and meet some of them before customers were driven to call for the information.

Data supporting this hypothesis include the change in the volume of requests from 1988 to 1989. The number of annual requests dropped 30% (from 238 to 167). Three-quarters of this drop occurred among requests that were handled on the day they were received. This suggests that the information was readily available from the Office, but had not been distributed to everyone who needed it. Also supporting this notion is the increase (from 17% to 33%) in the percent of requests fulfilled with the aid of the SPSSX statistical software. The SPSSX resource is typically required for new varieties of information requests.

The data collection effort has also facilitated planning and scheduling. For example, the relatively high volume of requests received in January was not anticipated. Before the results of the data collection became available, January was assumed to be a relatively quiet month and an appropriate time to schedule the completion of pending projects.

Research Office Requests
Monthly Volume

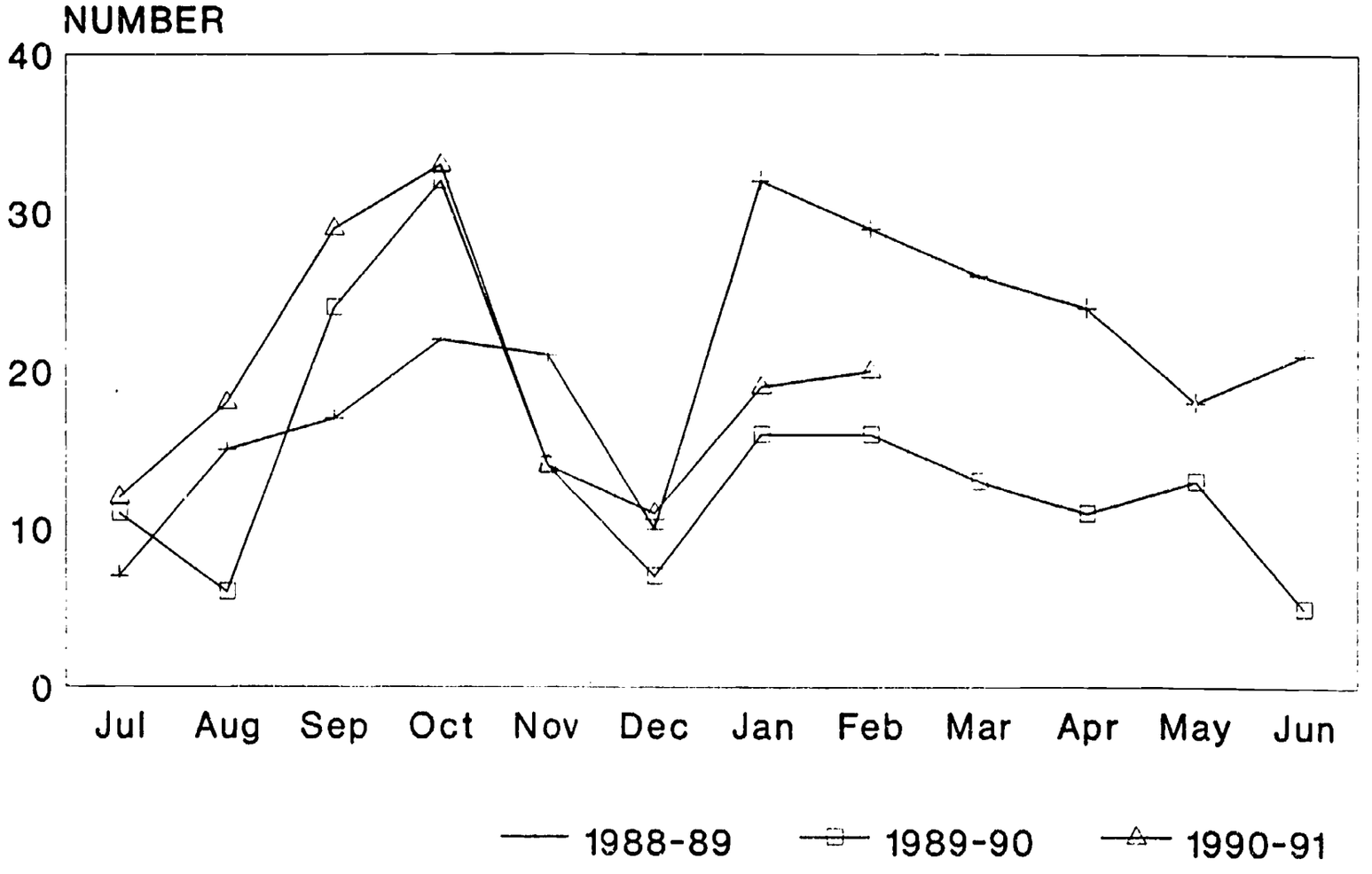

Figure 1

The request tracking system has also reduced rework, because operational definitions now describe how requests are handled. For example, if duplicate requests are received, the information can be pulled directly from the previous request, rather than repeating the effort of generating the information. On the other hand, apparent discrepancies in information provided to different customers are more easily resolved. For example, numerous studies have been conducted that track students to assess students' success in achieving their educational goals. The patterns of results are consistent from study to study, but they can appear different if studies using different operational definitions (of terms such as "retention" or "program completion") are compared. Educating internal customers about these definitions and helping them to identify appropriate comparisons reduces confusion and frustration. An additional benefit is that customers learn about the different varieties of data that are available, and they begin to better understand their information needs and to communicate them more clearly.

Assimilating Total Quality into Daily Management. At first, efforts to apply Total Quality Management were sporadic. In 1991, in an effort to infuse Total Quality Management into the daily management of the college's administrative operations, the president created a Kaizen-based model to describe the roles of college administrators. Improving and maintaining processes are at the heart of all administrators' responsibilities. Each area's responsibilities for 1991 are to: identify the area mission; identify and create flow charts of the area's key processes; identify quality characteristics and develop performance measures

of each key process; develop a data collection plan for monitoring these key processes.

The Research Office staff have completed the initial phases of this work. The Office's mission statement describes how the office mission supports the college mission, and it outlines the beliefs and values that underlie the office's mission statement. Key processes were identified by having Research Office staff and internal customers rate the importance of all Office processes. "Key" processes were operationally defined as those processes most critical to the college's mainstay processes of teaching and learning.

This data gathering generated seven key processes. Table 1 shows the five key processes identified by the Research staff. It is noteworthy that the process rated most highly by internal customers was "providing information, research, and statistical support". This service addresses the "ad hoc" requests, described earlier, that had been viewed as constantly interrupting the Office's "real work". The data showed that this is a key service that should be monitored to anticipate the information needs of college staff. The Research Office staff and internal customer surveys agreed in some respects, but differed in others, exemplifying the Total Quality premise that customer needs must be carefully researched and that it is dangerous to rely on opinions about customer needs.

Value of Assimilating Total Quality into Daily Management. Critical to the success and usefulness of these activities is the involvement of staff in the area undergoing study. The process of developing a mission statement, for example, led to a discussion

Table 1

Staff Ratings of Importance of Research Office Processes*

Processes/Associated Products.	Mean Rating	Range of Ratings
1. Preparing Third Week Reports	3.0**	0
2. Preparing Grade Distribution Reports	2.0	0
3. Preparing Retention Reports	2.3	2
4. Preparing Student Profiles/Summaries	2.3	1
5. Preparing Placement test updates	2.0	0
6. Providing information, research, support, advice internally (to staff)	3.0**	0
7. Providing information to external requesters for data.	1.0	2***
8. Preparing feasibility reports	3.0**	0***
9. Updating key indicators	3.0**	0***
10. Conducting graduate follow-up survey	3.0**	0
11. Conducting high school senior survey	1.0	2
12. Conducting employer surveys	2.0	2
13. Conducting alumni follow-up surveys	1.7	1
14. Updating Planning Digest	1.0	0***
15. Supporting internal (staff) TQ training efforts	2.7	1
16. Supporting TQ training for business/ industry (Community Ed. Workshops)	2.7	1

* Based on 3-point rating scale, with "3" highest in importance
** Identified as key process
*** Range is greater than number indicates, because one rater used the "?" option

of how the Office fulfills its mission of communicating and sharing information while maintaining appropriate standards of confidentiality. The importance of confidentiality had always been accepted by staff, but never before had staff operationally defined its meaning vis-a-vis the office's activities.

The creation of top-down flow charts for key processes has also been beneficial. For those processes that are operating with little or no complexity (extra or unnecessary steps in the process), the flow chart documents and standardizes the process. As a result, when the process is repeated there is no need to mentally recreate the steps in the process or to search for the data files needed to conduct the analyses.

For other processes, however, the flow charts will identify concerns or problem areas. Total Quality tools can be used to study the problem areas and to work through iterations of the Plan-Do-Check-Act cycle until the problem is resolved and the process improved. One example of this is a flow chart being used to document progress in conducting the annual county-wide high school senior survey. In 1989 the chart revealed a major bottleneck in this process. In conducting the 1990 surveys, a new statistical package option was used to eliminate unnecessary steps at the point where the bottleneck had occurred. As a result, the 1990 surveys were completed on time (instead of four months behind schedule) and with fewer staff resources devoted to it. It was not necessary to hire a part time worker for three weeks, as had been required in 1989 to complete the surveys. In addition to this saving, less regular staff time was devoted to the survey in 1990. The staff resources freed with the new method

were far greater than the time required (approximately 8-16 hours programming time) to set up the new system. This illustrates the Total Quality Management premise that process improvement leads to increasing quality and thereby to lower costs (Tribus & Tsuda, 1985).

Impact on Research Office Function. Implementation of Total Quality Management has changed the character of the work done in the Research Office. Rather than expecting the Research Office to take responsibility for all phases of every study, the Office is increasingly being used in a consultative fashion, to provide guidance and support to cross-functional teams and departmental groups. Administrators and staff formulate their own questions and problem statements, and they are responsible for all phases of the PDCA cycle used in process improvement. As a result, ownership of the data resides with the customers, not with the Research Office. The results of data analyses are more likely to be used, partly because of customer ownership and partly because the "Act" step in the PDCA cycle demands it. Finally, because administrators have been trained in Total Quality, a common language exists for describing data patterns in ways that were not feasible before Total Quality was implemented.

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